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CHROMATOGRAMS OF GRAIN AND FLOUR

EHRENFRIED E. PFEIFFER

Using the circular chromatographic method already described in BIO-DYNAMICS No. 50, Spring 1959, it has been the endeavor of the Biochemical Research Laboratory to build up a series of standards with regard to the quality of agricultural products, seeds, fruits, vegetables, herbs, etc. This work has led to many interesting observations. One of our primary interests was to determine the character of a natural product as it had been grown under well known conditions and to follow up the fate of this natural product during processing.

The German philosopher and poet, J. W. Goethe, had already coined a phrase 150 years ago which is of the utmost importance with regard to the recognition of natural biological quality: "The whole is more than the sum total of its parts." This means that a natural organism or entity contains factors which cannot be recognized or demonstrated if one takes the original organism apart and determines its component parts by way of analysis. One can, for instance, take a seed, analyze it for protein, carbohydrates, fats, minerals, moisture and vitamins, but all this will not yet tell how good the seed is, how well it will germinate; it will not tell its genetic background or its biological value.

Biology today recognizes such terms as "directional" or "organizing factors" which cause a living organism to germinate, reproduce, etc.; in brief, to put the right process into the right place at the right time. Thus, a pattern of growth, of life, of health (normal growth and metabolism) or of disease (abnormal growth, abnormal metabolism) develops. Growth or life forces are at stake. An older concept of the past spoke of a vital force per se. Modern science is reluctant to accept the existence of such a life force and rather tries to demonstrate only the presence of well defined chemical substances. It is willing to accept such terms as "directional, organizing factors". It also tries to find out whether the seat of life can be discovered in any particular substance or part, for instance, the cell, the plasma, the nucleus, etc. All trials of manifold procedures of investigation have led to great discoveries about the biochemistry of a living cell and/or

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Threefold Farm Spring Valley, N. Y.

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organism but have not yet given the answer to the question, "What is life?". At best, they have shown how life operates.

The words of Goethe, quoted above, contain a deep philosophical implication which the biologist sees before his observant eyes every day: the sum total of all the detailed analyses of form and substance does not as yet tell the "why" of life. It only informs about the "how". The approach to this question leads to a functional concept, because in this function we see the outstanding feature of a living organism. Life as a whole is more than the sum total of all biochemical reactions or the form pattern of the organism, cell, seed, or whatever, which is to be investigated.

Of all the scientists, the physicist, Erwin Schroedinger, whose contributions to the quantum theory of the atom have earned him a Nobel prize, has probably given one of the most interesting answers. He outlined in a series of lectures in February 1943 in Dublin* that an organism maintains itself because of its metabolism, which is in a continuous process of exchange of substance. Nutrition provides this substance.

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* In "What Is Life?", published in New York by Macmillan in 1946 and based on the Dublin series, Schroedinger says (pages 74-75 and 77): "How would we express in terms of statistical theory the marvelous faculty of a living organism, by which it delays the decay into thermodynamical equilibrium (death)? We said before: 'It feeds upon negative entropy', attracting, as it were, a stream of negative entropy upon itself, to compensate the entropy increase it produces by living and thus to maintain itself on a stationary and fairly low entropy level. . . . Hence the awkward expression 'negative entropy' can be replaced by a better one: entropy, taken with the negative sign, is itself a measure of order. Thus the device by which an organism maintains itself stationary at a fairly high level of orderliness (fairly low level of entropy) really consists in continually sucking orderliness from its environment. This conclusion is less paradoxical than it appears at first sight. Rather could it be blamed for triviality. Indeed, in the case of higher animals we know the kind of orderliness they feed upon well enough, viz. the extremely well-ordered state of matter in more or less complicated organic compounds, which serve them as foodstuffs. After utilizing it they return it in a very much degraded form — not entirely degraded, however, for plants can still make use of it. (These, of course, have their most powerful supply of 'negative entropy' in the sunlight.)"

"An organism's astonishing gifts of concentrating a 'stream of order' on itself and thus escaping the decay into atomic chaos — of 'drinking orderliness' from a suitable environment — seems to be connected with the presence of the 'aperiodic solids', the chromosome molecules, which doubtless represent the highest degree of well-ordered atomic association we know of — much higher than the ordinary periodic crystal — in virtue of the individual role every atom and every radical is playing here."

But, in addition to substance, energies are also involved. Usually these energies are described in terms of calories. But it is neither the exchange of substance alone nor the use of caloric energy alone which explains life.

The stroke of art, so says Schroedinger, by means of which an organism maintains itself in an orderly state, that is, a high degree of order (or organization) exists in the fact that in reality this organism absorbs from its environment continuously the principle of *order*. It is the well organized state of matter which serves as food, which supplies the more or less complex organic compounds to serve as food. Each higher organism builds itself up by absorbing (digesting) material provided by a lower order of life. There are different degrees of order in our food. There is also the principle of a dynamic state, an equilibrium or balance involved.

It is not our intention at the moment to enter into a discussion of the philosophical problems involved; we only wanted to raise the question. In nutrition, however, a concept evolves which indicates that the mere presence of substances does not sustain life or health but that, in food, we receive other qualities which go above and beyond the concept of defining proteins, carbohydrates, fats, minerals, vitamins, enzymes or calories alone. The way a plant has grown or an animal has grown and has built itself up, whether it received plenty of light, which makes it synthesize its body, have a determining influence upon its quality and true food value.

Our approach was entirely empirical, though with an open mind and no prejudices in any direction. We wanted to see whether it could be demonstrated that a living seed is different from the very same seed if "life", that is, the ability to germinate, has been removed. We wanted to see whether that which lives in a living seed can be maintained when processing this seed for food, for instance, by milling it to flour and baking bread.

It is known, of course, that vitamins and enzymes, the powerful biocatalysts in any metabolism, can be destroyed under some circumstances, but we were looking for an easily demonstrable, visible method of making this clear to the observing eye. Using said circular chromatographic method which has already helped to differentiate a living soil from a dead soil, a biologically better equipped compost from a poorer one, a natural vitamin with its component accompanying factors from a pure, synthetic vitamin, we just attempted to test with this method the

life history of seeds, the pathways of processing.

In this article a few facts and observations observed in the experiment will be described. Because of limitations of space and available funds, we can give only a few illustrations, but we hope that eventually all the empirical material on hand can be published.

The chromatogram is made by extracting the wheat seed or flour for several hours with a solution of 0.5% sodium hydroxide. A round paper disc of 7″ diameter had previously been treated or sensitized with a solution of 0.1% nitrate of silver. This is our standard method, used for all pictures shown here. (For details see BIO-DYNAMICS No. 50). The solution to be tested is transferred by being sucked up with a wick and then spreads by capillarity into the treated filter paper. Once a certain point has been reached, the absorption is interrupted and the paper dried. Then it takes several hours to days for the color and pattern to develop.

It is now necessary for the reader to look at the illustrations as we describe them. Take the four pages of illustrations and open to pages 2 and 3 so that you have the whole sheet before you.

Illustrations:

No. 1: Extract from a wheat seed. This particular wheat was grown on a farm in eastern Pennsylvania, where the bio-dynamic method of compost and manure treatment with the B. D. Compost Starter is applied. Variety: Dual wheat, a soft red winter wheat, 1958 harvest. The chromatogram was made on April 7, 1959; therefore the seed was used about 8 1/2 months after harvest. The germination percentage was 94%, indicating a good quality seed. The following analytical data may be of interest: moisture 12.8%; crude protein as received 10.5%; same on dry basis 12.0%; 1000 grain weight 38 grams. The percentage of essential amino acids in the total crude protein was 21.1%, which is a low average.

The information the chromatogram gives is expressed in terms of form and color. The concentric rings are caused mainly by starch and, to a certain extent, by gluten, as we will see later (illustrations No. 23 and 24). The spokes more or less protruding from the outer ring area toward the center are caused by proteins and indicate quantity as well as quality of protein. They are also an expression of life, for in "dead" materials they disappear. The pink hue is thiamin, as we found out by com-

parison with chromatograms of pure thiamin. The most important features in this chromatogram, however, are the small round or berry-shaped holes or spots with practically no visible coloring, which appear just outside of the darker third ring (counting from the outside). These empty spaces appear only in live material. Between the darker, outermost ring and the lighter second ring (counting from the periphery) is a small ring zone, somewhat lighter colored, frequently almost white. This halo also is a sign of life and not found in "dead" material.

Under ultra-violet light of a wave length of 2537 $\propto$ and 3660 $\propto$ one can also see fluorescent rings, not visible in daylight, on the outer edge and in the center area, indicating the presence of niacin and riboflavin, if any. The intensity of color and the form pattern gives a measure, therefore, of certain component parts of the seed in addition to the "sign of life". The "sign of life", that is, the white spots, does not contain any identifiable substance.

No. 2: This wheat was now germinated according to standard laboratory procedures. The chromatogram made from the swelling seed on the first day of germination is entirely different from the whole seed. While the starchy fraction remains rather unchanged, the protein factor has undergone considerable changes, so that the original pattern disappears completely. Enzymatic processes take over which break down the original protein in the germ. There is still the "ring of life", the lighter shaded area; in fact, now we see two of these rings. As a whole, we interpret this pattern as being significant of a breakdown process of the seed metabolism; significant too is the contraction of pattern.

No. 3: On the second day of germination, again an entirely different pattern results. The concentric rings, so characteristic of the starches in the seed, are loosened up. This is obvious, because enzymatic processes have now started which begin to mobilize the reserve starch for the new growth and nutrition of the germ growth. At this stage, no roots or beginnings of leaves are visible as yet. The white ring of life is very clear.

No. 4: The germ has now properly germinated and started its own life and begins to grow visible; root tips show up and eventually the first leaf tip.

We see now in the chromatogram (a) the leftover of the broken down original seed material; (b) the influence of the first products of the new growth metabolism (synthesis). Clearly

visible protein spokes show up, quite different, however, from those of the original seed. More of the starch pattern (rings) got lost, the halo or ring of life is a little wider and the earliest beginnings of new, not yet quite empty spaces, show up. We know now that the new life and growth have properly started.

There is no space to show all the other day by day following chromatograms which, for instance, after one or two weeks of growth, show the chlorophyl and other products of synthesis and assimilation.

The pink hue of this fourth day is somewhat more intensive, indicating that more thiamin had been released from the original seed.

Illustrations No. 5 through No. 8 show examples to the contrary:

No. 5: The very same wheat as used for No. 1 through No. 4 was exposed to 212°F heat in a dry oven for 30 minutes and has lost its ability to germinate. Otherwise, a chemical analysis would still show about the same amount of protein, carbohydrates, fats and minerals. The moisture has been reduced from 12.8% to 10.9%. This, therefore, is a seed with the same major component parts, even the same amount of heat stable vitamins, but chemically it has lost some heat sensitive enzymes and, of course, life. Also the amino acid pattern has only slightly changed. In the chromatogram we therefore see all that which is left and unchanged (let us call it the gross chemical structure), but the empty spaces and the light halo-ring have disappeared.

This phenomenon was observed many times — that the lifeless substance does not produce these "signs of life".

No. 6: This seed was now soaked in a germinating tray exactly like the other. It did not germinate. It did get soft, however, and swelled up. We see a pattern entirely different from that of a germinating seed of the same age, that is, on the first day. We still see a halo; see the influence of protein; see thiamin; see the influence of starch, but now fading.

No. 7: On the second day of soaking the seed falls apart. All characteristic forms, especially those for proteins, fade out much more. As a whole, it is the typical pattern of a decaying process. While in No. 6 the third concentric ring showed a somewhat irregular and serrated borderline, a phenomenon which we learned is caused by enzymes, this enzyme pattern too fades out. Of course, these enzymes are not the same as those

employed in growth. But even a decaying process needs enzymes.

No. 8: On the third day of soaking, the process of disintegration has continued and the fading out has progressed. It is interesting that even then the pink color indicating thiamin is still present.

The comparison of No. 1 through No. 4 versus No. 5 through No. 8 teaches us several lessons: One: The difference between growth and decay, which at the same time is the difference between life and death. Two: Progressive changes and their different paths. Three: (and this is very important from a nutritional point of view): A sprout is quite different from day to day, so that its intrinsic nutritional value might be different. Judging from the pattern of the second day, we might draw the conclusion that the seed is in between old and new life, while on the third and fourth day the sprout begins to unfold its own life; that is, at the time when the first roots begin to show.

For those who like to eat sprouts because they feel that a living sprout might transmit more than just the mere substance of the seed, this knowledge may be important. Our personal opinion, based on our present knowledge, is not to eat the seed which produces the pattern of No. 2 but to prefer pattern No. 4. We purposely do not say second, third or fourth day because there might be slower or faster germination due to the age, viability of the seed or temperature and moisture conditions. Also, different seeds, wheat, rye, oats, alfalfa, may behave quite differently and require different time intervals. Therefore, the state of development, not the measure of time alone decides.

In any case, a seed with a low viability or a dead seed does not provide what the sprout eater is looking for.

Now we ask you to turn the sheet of illustrations around for a while and unfold pages 1 and 4; page 4 should be to the left and page 1 to the right. We begin with No. 17.

No. 17: Shows the chromatogram of a different wheat, also grown in 1958, at a bio-dynamic farm in New Jersey. This wheat analyzed as follows: moisture 11.7%; crude protein as received 10.4%; same on dry base 11.8%. The germination percentage was 92%; the thousand grain weight 39.0 grams, which is quite good. The percentage of essential amino acids of the total crude protein was 23.2%. The percentage of the 15 most important amino acids which we analyzed was rather high, namely, 89.6%. This already points to a high quality protein; for instance, lysine, which is usually low in grain (average for

wheat from literature 2.7%) was in this case 3.8%. Accordingly, in the pattern of the chromatogram we see the "spots of life" larger and more pronounced. The protein pattern also is different from other wheat origins. While the general principles in a chromatogram apply at all times, seeds or any produce from different provenences show variations of these principles.

No. 18: This very same wheat of No. 17 was now exposed to the rough heat treatment — exposure in a dry oven for 30 minutes at a temperature of 212°F. The germination of this wheat after exposure was the same as before, namely, 92%. We therefore have in this case heat resistant enzymes and proteins. This is a characteristic of many bio-dynamically grown wheats, as well as of some otherwise organically grown wheats. The chromatogram of the heat exposed seed, therefore, shows the signs of life again, inasmuch as this seed still germinated at the 92% level. This, therefore, is a seed with a high degree of vitality. (At some other time, we will discuss this problem at some length. Reference also is made to an article, "Quality Production of Seed Protein" in BIO-DYNAMICS No. 46, Spring 1948.)

Now we ask the reader to return to No. 1, the whole living seed, and to follow the next investigation group, pictured in No. 25 and No. 26, then No. 19 through No. 28 and No. 29. The purpose of this investigation was to take the seed apart, grind it to flour and separate the component parts of this seed; finally to put the component parts together.

No. 25: Demonstrates the chromatogram of the germ alone and No. 26 the chromatogram of the entire wheat berry but without the germ. Neither one, separated, shows the whole pattern of the seed; neither one is able to germinate; neither one reflects a living entity in its completeness, nor would the germ without the kernel be able to survive. The chromatographic pattern of the germ No. 25 has all the markings of protein and enzyme influences prevalent. The starch pattern is weak but still the last traces of the signs of life are recognizable.

The kernel without the germ No. 26 shows a strong starch and a lesser protein pattern. If one would project both pictures, one on top of the other, the original pattern of No. 1 would result, but without the empty space labeled as "sign of life". By separating the germs from the kernel, a deep incision into the structure of "life" has been made, even though, biochemically, the germ still contains many valuable ingredients. We observe

a somewhat different situation if the whole seed is gently ground to a whole wheat flour, without heating up.

No. 19: Shows the chromatogram of the protective layer, the bran and the aleurone layer, that is, the protein and enzyme carrying layers of the kernel. Here everything is still present — the protein, the cellulose, some starch, some enzymes and even the "empty space of life", but the pattern looks somehow squeezed, irregular and slightly damaged.

No. 20: Here the coarse bran (about 3%-5% of the whole wheat flour) has been separated and chromatographed. Some proteins and enzymes adhere to the bran, hence a pattern which allows recognition of its origin, but much squeezed and damaged. This is truly a tortured pattern. This, by the way, is the stuff livestock frequently gets in concentrates (bran) with some life attached, as the "leftover" from flour milling.

No. 21 shows another situation: bran and aleurone layer together. The characteristics of bran are minimal but the aleurone layer comes through clearly.

No. 22: This is the chromatogram of the white flour of an 80% extraction from which the bran and most of the aleurone layers have been screened off. There remain some protein, a few enzymes and almost all starch, and that is what the pattern indicates; also thiamin kicks through clearly. The gluten has now been separated by washing away the water soluble starch.

No. 23 is the chromatogram of the gluten, that portion which is so significant for wheat. We still recognize the last remnants of the protein spokes.

No. 24 is the pattern of the pure starch without the gluten. This is the typical starch pattern: concentric rings of different coloration. The water left over after the elimination of gluten and starch was concentrated and now contains minerals, all other water soluble substances which have remained and, above all, enzymes.

No. 27 shows the water soluble fraction after removal of gluten and starch. The edge pattern is typical for the presence of certain enzymes which can be identified by comparison with suitable enzyme patterns (cf. BIO-DYNAMICS No. 50, illustrations No. 20 and No. 24).

No. 28 shows the chromatogram of the water soluble extraction from the aleurone layer. This chromatogram has a very significant enzymatic pattern and tells exactly where the most powerful enzymes are located in the berry. Enzymes, too, are

proteins of a very complex structure. The protein spokes of the enzymes are quite different from the mass or crude protein; hence we have a radiating pattern all the way through.

No. 29: All the parts which we had separated out of the original whole grain — the protective layer, the bran, the aleurone layer, the gluten, the starch, the water soluble residues — all which had been taken apart have been mixed together, so that the SUBSTANCE of the original grain was collected and re-united. The chromatogram of this composite mixture of all component parts of the grain in No. 1 shows all the markings of starch, of protein, of thiamin and of cellulose, but it does not show the enzymatic pattern which had been destroyed in the process of taking apart, even though we could catch it in the residue. But, re-united, these enzymes were not effective any more. The sum total of the parts, however, does not give us back the original manifoldness, color and form of the living seed. It is a sum total of chemicals and of substance but no longer of life. The original life has vanished, as have the empty spaces and the halo, which were so significant in the living originals.

The words of Goethe, "The whole is more than the sum total of its parts", have been demonstrated in an experiment which in every step follows a rational schedule of separation and of possibility of identification of the parts.

Whoever studies these chromatograms carefully and studies the chemical background which leads to them, moves in a realm of observable reality. A new vista has been opening before his eyes. He need not speculate philosophically, "What is life?" but he can see with his own eyes to what extent life exists, how and when, and under what conditions it is lost. If he has an unprejudiced mind and proceeds empirically and not speculatively, just basing his conclusions on phenomena and nothing else, he can conclude: Life is an expression of the whole, untampered with, not yet separated and left in the state in which nature has produced it. The implications of this statement are many; the consequences are great. This writer and his coworkers became fascinated by the problem and its many possibilities of application.

The reader is now asked to look at illustrations No. 9 and No. 10, showing the same soil chromatographed from the same field from a farm in Indiana. The farmer grows peonies. On the field is a section which is barren, while the rest of the field grows splendid peonies. Chemically, there was no significant

difference in the analyses of both sections, the poor and the good one. The matter was referred to this laboratory. Chromatogram No. 9 tells us that this section lacks air and circulation (drainage problems), so that structural problems exist, causing the roots to die out, while No. 10 from the good section does not show this damage. The poor section contained 50% very fine silt particles; the good spot only 35.3%. The poor spot was occluded.

We return once more to the problem: whole seed and separation into germ alone and kernel alone, without seed, this time demonstrated with corn. We picked out a corn, N. J. No. 9, which grew very well at Golden Acres Farm, Newtown, Pa.; in fact, of all the various varieties grown there in 1959, it performed best and stood up best.

No. 11 shows the chromatogram of the whole seed from the corn which germinated 96%. Corn chromatograms are, of course, different from wheat; the protein-enzymes spokes are different; the empty spaces do not show up as holes, but the light ring of life can be seen (third color change, counting from the outside, before the protein spokes). Thiamin and enzymes show up in the radiating pattern and in the pinkish hue.

No. 12 is the chromatogram of the germ of this corn. We see the squeezed pattern; we even see some of the empty spaces (= holes), the sign of life, but we see a damaged pattern because the germ was separated from the whole.

No. 13: Again the chromatogram of the rest of the seed without the germ shows all that there are — starch, protein, zein, thiamin influences — but not the whole.

By the way, pattern No. 11 points to a better quality of corn. Chromatograms of poorer quality corn are quite different, so that the method could be used for grading.

Then we got further interested in the case history of the pathway from grain to dough to bread, which is illustrated by No. 30 through No. 32.

No. 30: Shows the chromatogram of the flour (whole wheat) from a hard spring wheat organically grown in Kansas. The wheat had a good chemical composition of 14% crude protein, as received at 12.7% moisture, or 16.0% protein on dry base. Even for a hard spring wheat, this is considered to be a good quality. Lack of space does not permit showing the chromatogram of the seed. The germination percentage was 94%, but the wheat did not have the vitality to permit it to germinate

after exposure to heat. The flour, therefore, even though it was whole wheat flour, had lost some of the qualities of the seed. Maybe the miller did his share to it too.

No. 31 is the chromatogram of the dough made from this flour. The dough contained the flour ground just before baking; that is, the flour had not steamed out or settled. In a settled flour, the pink of thiamin should kick through more strongly, as was the case in No. 30. 3 lbs. of flour were mixed with a solution of 3½ teaspoons salt, 1½ oz. honey, 1½ oz. sugar, 2 ozs. of dry yeast, in ½ cup of tepid water, plus 3½ cups of scalded milk. The flour was mixed by hand for 5 minutes with all the ingredients but the yeast; then the yeast was added, mixed again for 3 minutes, 3 oz. of shortening added and kneaded for 15 minutes. The dough was put in a cold oven to rise for 1 hour and 15 minutes; then it was punched down, folded four ways and turned over. It was then cut in three loaves, shaped in round balls, settled for 10 minutes, shaped in loaves and allowed to rise in the pan for another 45 minutes. The bread was baked for 15 minutes at 400°F; then for 20 minutes at 375°F. We state all these details because later experiments showed that the mixture, rising time, frequency of rising, baking temperature and time have a tremendous influence on the quality of bread which can be demonstrated with the chromatograms. Since this publication is limited to 32 illustrations, it is intended to bring all further observations on dough and bread problems, on baking time and heat, in one of the next issues of BIO-DYNAMICS. Here we can present only a glimpse of the problem for the time being.

The pattern of the dough is entirely different from that of the grain and flour. The pinkish thiamin hue comes very much to the fore. The proteins are visible as small spokes protruding from the outer ring inward. The starches are completely changed. The pattern, however, is most significant for the action of the yeast. Actually, it tells, as other experiments have taught (which have to be reported some other time) how well and to what extent the yeast can revitalize the flour mixture. A new life principle enters. Even if a flour was really "dead", the yeast could introduce a new life principle. Much depends now on the quality and vitality of the yeast and on the procedure and time of rising.

No. 32: The chromatogram of the bread actually tells how good the bread is, that is, how much of the original seed, flour, dough and yeast are left. As far as we can judge from our

present experience, the bread pattern in most cases is an arrested dough and fermentation pattern. Few markings of the original grain or seed have been retained. The reader is advised to compare No. 32 (the bread) with No. 1 or No. 17 to realize how much of the origin has survived. Furthermore, to compare it with No. 25 (the germ pattern) and No. 26 (the berry pattern); finally with No. 30 (the whole wheat flour pattern). He will discover indications of all these patterns, but much reduced and changed.

We have worked with many different breads and will devote a special publication to the subject. While this particular bread of the No. 32 pattern was one of the better breads we have tasted, truly a whole wheat bread, we were disappointed that the original life and seed pattern did not penetrate more strongly. We would like to see a loosened up outer ring pattern, for instance. The yeast has definitely reinforced the thiamin hue and even helped to maintain it in the bread, but many intrinsic factors of protein, starch, and enzymes are no longer present.

Our laboratory then began to study yeast, doughs and bread. So far, of the many breads we have tested, only three have shown a reasonably satisfying pattern. It is now necessary to check into all the problems of bread baking. The question is raised, but it will take much time and patience to collect all the answers.

The first step was to investigate yeasts. The opportunity arose because we got many different yeasts for study. This writer has always had a great interest in yeast; in fact, many years ago before the war he produced a patent on a procedure for yeast testing, evaluation of yeast performance, quality, and vitality and cooperated with one of the largest companies producing yeast in Europe.

The reader should now turn to page 2 and 3 again — No. 14, No. 15 and No. 16.

No. 14 shows a debittered Brewer's yeast with marked protein and enzyme signs. This yeast was used medically and apparently performed satisfactorily, according to our informant.

No. 15 shows another yeast, a primary food yeast, also with a satisfactory protein and enzyme pattern but not as diversified as No. 14.

No. 16 shows a yeast which was given to us as an excellent food yeast. We cannot agree. This pattern is not one of great enzymatic activity. It lacks all the detail the two other yeasts show.

Our yeast studies still continue. It is quite evident that the process of growing yeast, its nutrition, its aerobic or anaerobic growth conditions, have a decisive influence upon its quality. Since there is no more space for illustrations, we must let the case rest at this time. More details will follow soon, for they have already been assembled in our laboratory.

The scientific reader must forgive us for getting carried away at times in our report with philosophical problems and our enthusiasm. It is customary to report only data, but this is a rather dry, objective style. However, the problems and the vistas which have opened before our eyes are so paramount and lead to such an entirely new concept of investigation that we felt entitled to bring up basic and fundamental questions related to the preservation of life; at least as was the case in our study of seed to bread. We believe that much more work still needs to be done, but we have now also added a new approach to find out about Life by itself. The phenomena observed cannot be disputed, no matter what the explanation or theory may be.

MARK DOWN THESE DATES: JULY 9th and 10th

Of course the above is only a suggestion, and is only meant for those who might be interested in attending the annual Bio-Dynamic Farming and Gardening Conference at Threefold Farm, Spring Valley, N. Y. Every year, the accommodations at Threefold Farm fill up rather early, and recently the latest comers have had difficulty in finding rooms nearby. You can get further details as to reservations by writing to Mrs. Richard Kroth at the above address. Applications for space should be accompanied by a $5 deposit.

Programs will reach B. D. Association members, and subscribers, in advance of the meeting, but we have found it impractical to send them out too far ahead. Often, shifts and changes have to be made in early plans, and the finances of the association won't allow for 2 sets of programs going out.

For new readers, it might be mentioned that *anyone* interested in attending the sessions is welcome.

F. H.

NEW JERSEY NFA HEARS SCIENTISTS

Dr. John B. Schmitt, Professor of Entomology at the College of Agriculture, Rutgers University, was one of the scientists who addressed the State Meeting of the New Jersey Chapter of Natural Food Associates, Inc., at Rutgers on February 13th. Others included William E. Smith, M.D., Director of the Nutrition Research Laboratory at Fairleigh Dickinson University, and Dr. E. E. Pfeiffer, Director of the Bio-Chemical Research Laboratory, Spring Valley, N. Y., and a National Director of NFA.

In his talk on "Biological Control", Professor Schmitt expressed a point of view increasingly heard from "official" entomologists, though far from common (at least in public utterance) in such quarters not so many years ago. He said that it was fortunate that in recent years much thought was being given to combining *biological control* of insect pests with suppressive treatments. He illustrated, with a series of graphs projected on a screen, how the numbers of particular crop pests fluctuate up and down as the equilibrium between a pest and the parasites and predators that keep it in check may get temporarily out of balance.

When the numbers of the insect reach a certain point, economically ruinous to the grower's crops, thus crossing "the economic threshold", Professor Schmitt said, suppressive treatment becomes necessary. Under the concept of *"Integrated Control"*, he emphasized, such treatment is applied only when the abundance of the particular pest reaches that point. The aim then, he went on, is to enable the grower to get a crop, yet not leave residues* from the treatment.

For the "Integrated Control" approach to be effective, Dr. Schmitt emphasized, three things are necessary:

1. There must be thorough study of basic economic conditions.
2. There must be competent insect population samplings.
3. There must be the release into their environment, of the maximum numbers of enemies (predators and parasites) of the harmful insects.

He added two further points: the need for finding *selective*

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*Editor's Note: It should perhaps be recalled here that some of the newer spray treatments, which indeed do not leave residues that might poison the consumer, have the disadvantage that unless used with extreme precautions they can be most toxic to the user, the man that applies them.

treatments that will kill the pest and not the predator, and will also break down rapidly after their use; also the need for much research directed toward the biological handling of virus diseases, etc., that again will help toward keeping crop pests in check below the "economic threshold."

In leading up to the above conclusions, the speaker gave the example of the cottony cushion scale, a serious pest for citrus growers, being pushed and kept down below the economically harmful level by the introduction of a predator, the ladybird beetle.

"This was highly successful", he said. "But when DDT was introduced the situation got worse rather than better, because the predators were wiped out."

Earlier, Dr. Ordway Starnes, Associate Director of the New Jersey Agricultural Experiment Station (at Rutgers), had welcomed the N. F. A. members to the Rutgers Campus. In the course of his remarks Dr. Starnes stated that "We share with you a common concern over the threats to survival which have accrued from findings in the physical sciences rather than research in the biological sciences."

The address of Dr. Smith, of Fairleigh Dickinson University, was entitled "Cancer and Nutrition." He referred, first, to surveys on the part of insurance companies checking out cancer claims, in which they found that overweight people would develop cancer 50% more frequently than underweight people. These have led many research men (including himself) to use small animals for studies of overweight as a possible pre-disposing factor. When animals equally predisposed to cancer for other reasons are divided into two groups, with the one being given all they want to eat and the second group kept thin by limiting the food supply, he said, many of the first group develop tumors while you find that with the thin ones "you can practically prevent cancer — sometimes not any animals in the second group develop cancer."

He said that since the data showed a striking relation between diet and the frequency of cancer in animals, and the same thing seems to be so in human beings, "this would suggest that it would be prudent to avoid overweight, as one factor in trying to avoid the incidence of cancer".

Dr. Smith emphasized that any diet planned with this in mind must, of course, include the essential nutrients and avoid excess calories. He said it would include fruits, vegetables,

wholegrain cereals and meats, whereas "desserts, soft drinks, cocktails, snacks, are things we do not need and that contain calories". He added the general fact that "lean animals — and lean people — tend to live longer than those that are overweight."

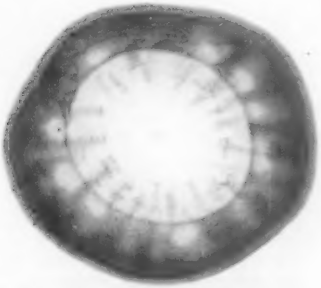
In discussing specific substances that tend to induce cancer in animals, Dr. Smith, whose report to Congressman Delaney, given at the latter's request, was perhaps the most important factor behind the "Food Additives Amendment of 1958" told of some interesting facts in connection with small amounts of cancer-inducing substances.

He said he had frequently given very small doses of particular substances to animals, with no immediate evidence that these induced cancer. Then, many months later in the case of mice injected when very young — i. e. at a time corresponding to middle life in human beings — they *do* get cancer.

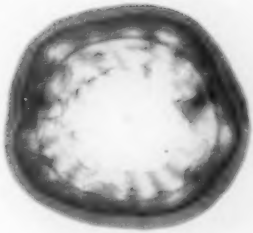
Dr. Smith held that the forbidding of the use in foods of any substance causing tumors in animals was "a prudent step", and commended Secretary Fleming for his rulings on the cranberry case and on the use of stilbestrol, an artificial female hormone, for making capons. He warned that the whole principle would "be under fire from here on out," with strenuous efforts being made to return to the principle of "tolerance levels" as worked out on animals and then applied to human beings. He said that while in theory there "might be" such tolerance levels, our scientists do not know how to delimit them if they exist.

Yet, Dr. Smith commented, legislation is hardly a satisfactory way of achieving protection unless the underlying philosophy supports it. Speaking in an urbane, quiet tone, he said, with a smile that as it is now new chemical substances devised by the bright, young chemists, keep coming off the chemical assembly line. You test them on animals, and if they are not too toxic you try to sell them as a food additive. If the substance turns out to be a wingding poison, you try to sell it as a pesticide; and the trick is to adjust the dose so it will kill the insect and not kill the customer.

"It is a question of philosophy. I think the time will come when the chemical companies themselves will take the lead and say, We'll confine ourselves to paints and varnishes and the like, and not try to use in foods that which won't go into paints and varnishes.



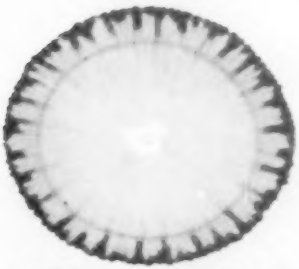
#19. PROTECTIVE LAYER, BRAN AND PART OF ALEURONE LAYER OF WHEAT AS IN #1.



#20. BRAN ONLY OF SAME WHEAT AS IN #1.

#23. GLUTEN EXTRACTED FROM SAME WHEAT FLOUR AS IN #22.

#24. PURE STARCH EXTRACTED FROM SAME WHEAT FLOUR AS IN #22.



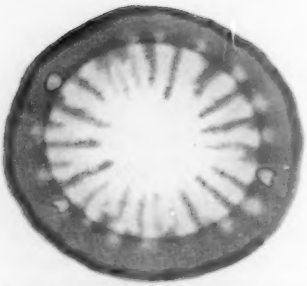
#27. WATER SOLUBLE RESIDUE AFTER GLUTEN AND STARCH EXTRACTION (ENZYME PATTERN).

#28. WATER SOLUBLE RESIDUE FROM EXTRACTION OF ALEURONE LAYER (ENZYME PATTERN).

#31. DOUGH MADE FROM SAME FLOUR.

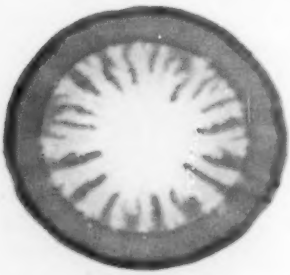
#32. BREAD MADE FROM DOUGH AS IN #31.

THE ILLUSTRATIONS ARE APPROX. ONE THIRD OF NATURAL SIZE.

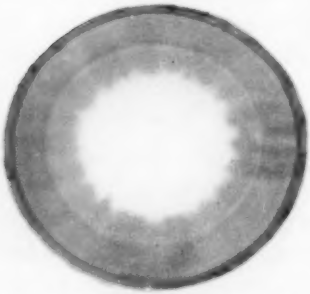


#1. WHEAT, WHOLE SEED (G.A. '58) 94% GERMINATION POWER.

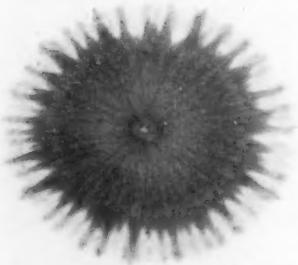
#2. SAME WHEAT, FIRST DAY OF GERMINATION.



#5. SAME WHEAT. 30' HEAT EXPOSURE. NO GERMINATION.

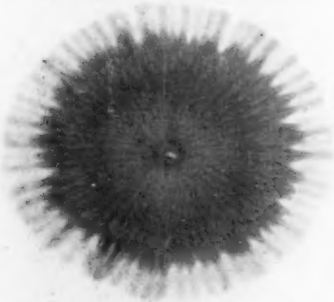


#6. SAME SEED SOAKED ONE DAY.



#9. SOIL FROM A PEONY FIELD. POOR SECTION, NOTHING GROWS.

#11. CORN N. J. #9, GROWN BIO-DYNAMICALLY, WHOLE SEED.



#10. SOIL FROM SAME PEONY FIELD WITH GOOD GROWTH.

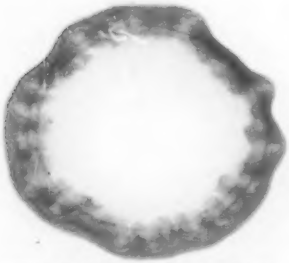
#14. FROM A DEBITTERED BREWER'S YEAST WHICH SHOWED A SATISFACTORY MEDICAL RESPONSE.

#3. SAME WHEAT, SECOND DAY OF GERMINATION.

#4. SAME WHEAT, THIRD DAY OF GERMINATION.

#7. SAME SEED SOAKED 2 DAYS.

#8. SAME SEED SOAKED 3 DAYS. NO LIFE.



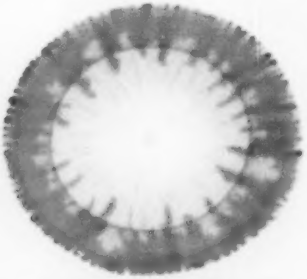
#12. GERM ONLY FROM CORN PICTURED IN #11.

#13. SAME CORN AS IN #11, FLOUR WITHOUT GERM.

#15. ANOTHER YEAST OF LOWER QUALITY; (A PRIMARY FOOD YEAST).

#16. A POORER QUALITY YEAST.

#17. WHEAT BIO-DYNAMICALLY GROWN. 92% GERMINATION (AS '58).

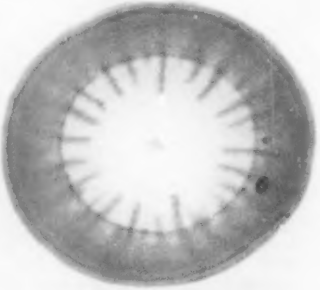


#18. SAME WHEAT AS IN #17. 30' HEAT EXPOSURE. 92% GERMINATION.

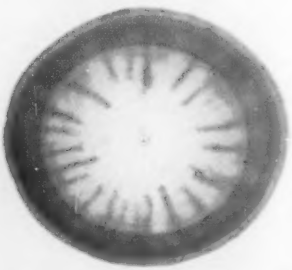
#21. BRAN AND ALEURONE LAYER ONLY OF SAME WHEAT AS IN #1.

#22. WHITE FLOUR MADE FROM SAME WHEAT AS #1. 80% EXTRACTION.

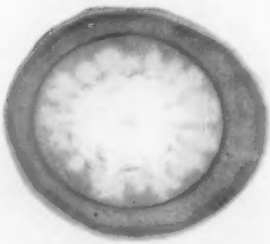
#25. GERM ONLY OF SAME WHEAT AS #1.



#26. BERRY WITHOUT GERM OF SAME WHEAT AS IN #1.



#29. MIXTURE OF FLOUR, BRAN, STARCH AND GLUTEN OF SAME WHEAT AS IN #1. THE ORIGINAL PATTERN CANNOT BE RESTORED.



#30. FLOUR FROM SPRING WHEAT.

PLATES AND PRINTING BY FAIRFIELD LITHO CORP., STAMFORD, CONN.

"I am joking in my expression of this, and of course I would not remove things that are necessary and right in foods. Table salt, for instance, is a chemical. But seriously: one ought not to take a new substance, test it on a few animals and then get it authorized for foods".

He amplified this with the assertion that safety simply cannot be tested by a limited series of animal experiments and that it is just a guess that certain concentrations will not do harm to people. He held that the consumer should not be compelled to accept risks of unknown dimensions in connection with things such as additives, which are not necessary as a food.

Dr. Pfeiffer, speaking on "Natural Food Quality", presented some of the results of his use of chromatography in studies of the amino acids. He stated that the research accomplished, "research that can be checked by investigation", was such that it "entitles us to bring up questions of food quality, without being subjected to charges of faddism". His talk was illustrated with slides of some of the chromatograms.

Touching on food production by the Bio-Dynamic Method, including the use of organic composts treated with bacterial cultures, Dr. Pfeiffer cited some compost recently produced by Heinz Grotzke of Golden Acres Farm, Newtown, Penna. which contains 2% Nitrogen, 3½% Phosphate and 1% Potash. The speaker termed it "one of the best in the U.S.A.."

Earlier at the day's session, Devin A. Garrity, the publisher, of New York City, a National Director of Natural Food Associates, had spoken on "NFA, Today and Tomorrow". Ethel E. DeLoach, State President, presided.

Moderator at a panel discussion that concluded the meeting was Dr. Winston H. Bostick, head of the Physics Department at Stevens Institute, Hoboken, and program director and vice chairman of the New Jersey Chapter of NFA. Participants in the discussion were Paul Keene of Walnut Acres, Penns Creek, Pa., Mr. Grotzke, Joseph Carsten of Deer Valley Farm, Guilford, N. Y. and Peter Escher, Threefold Farm, Spring Valley, N. Y. The meeting was well attended.

FRED HECKEL

GROTZKE COMPOST

When Dr. Pfeiffer, at his recent talk to the New Jersey N.F.A. meeting at Rutgers, made enthusiastic reference to the compost recently produced by Mr. Heinz Grotzke at Golden Acres Farm, a representative of this quarterly asked the producer if we could have some detailed facts and figures on it. Mr. Grotzke very kindly obliged:

Materials: ca. 90 tons chicken-manure
ca. 80 " coffee-waste
ca. 3 " straw
10 " hybrotite

Made on: September 11, 1959.
1st turning: October 14.
2nd turning: November 4.
Black plastic cover put on: November 7.
Hybrotite put on: first half of January.

Temperature development:
Before 1. turning: up to 150 degrees F.
After 1. turning: up to 120 degrees F.
After 2. turning: warm

Dr. Pfeiffer's findings were:
Structure : crumbly, fine, granular
Color : black brown
Odor : very earthy
pH : 8.0

	As received	On dry basis	Moisture 16.2 %
Moisture :	42.4 %	0.0	16.2 %
Organic Matter :	19.2	33.4	28.0 %
Inorganic Matter :	38.4	66.6	55.8 %
Total Nitrogen :	1.32	2.29	1.92%
Total Phosphates :	2.18	3.78	3.17%
Total Potash :	1.00	1.71	1.43%

Screen Test: passed No. 10 screen (0.0787") : 80.5%

CULTIVATED HERBS — YESTERDAY AND TODAY

HEINZ GROTZKE

The term herb is generally applied to plants of which the leaves, seeds or roots are used for medicine, or they are grown for their scent and flavor. Not all of them need to be cultivated, a great many flourish as wild plants in forests and meadows or wherever vegetation can be found. Some are even called weeds as soon as they appear on lawns, in gardens or fields. Man is their judge and decides whether weed or herb. The variety of wild herbs outnumbers the cultivated herbs by far. This article, however, will be dealing with the latter only, because caring for them will open to the passionate gardener a field of exploration. Herbs have been companions of man through thousands of years. The expression is tied to thoughts of medieval medicine, pictures appear of witches and their steaming tinctures, tales are remembered of monks as the artists of gathering herbs, turning them into the essence of piquant liqueurs.

The practice of herb growing reaches far back into the days when Egyptian culture ruled the world. Fragrant substances found generous uses in religion and cosmetics. Though nobody remembered what perfume made Nofretete so attractive, it is known that poppy, caraway, and mint are among the earliest herbs ever grown by man. A thousand years had to pass, however, before the culture and processing of herbs was recognized as a part of science. The Greek philosopher Theophrastus (372-287 B.C.) is looked upon as the founder of this branch of science. He was a well-known botanist and described in detail herb gardens which he saw in Asia Minor almost four centuries B.C. Also the Romans took care of extensive herb gardens and knew how to employ them wisely in medicine. A wide variety of herbs originate in the Mediterranean basin. Another thousand years went by until herb growing developed fully in the 11th century when the monasteries started to specialize in the cultivation of these plants. Especially the order of the Benedictines with their center in Monte Cassino, Italy made it part of their task to spread the knowledge and culture of herbs throughout Italy and Northern Europe. It was a duty of their order to cultivate the land and practice horticulture. Gradually the gardens of the monasteries became the centers of herb growing. When later druggists began to grow herbs in their gardens, monks handed them the seeds and plants and gave advice on how to handle them. The

profession of the druggist developed in the Middle Ages, greatly initiated by herb growing. A druggist was a man who grew herbs as a source for his medical preparations. So he was not only a medical man, but became also a botanist. Like Paracelsus (1494-1541) many medical doctors strongly patronized herb growing in their time by emphasizing the importance and usefulness of herbs in medicine.

The invention of printing opened a new era to the growing and use of herbs. Numerous herb books were published, rapidly spreading the knowledge and practices of herb culture and the many ways of their utilization. From then on commercial herb growing was gradually born and began soon to specialize. Herbs were grown in areas ideally suitable in climate and soil. They, on the other hand, also entered the gardens of farmers and home-gardeners who found joy and recreation in experiencing the rhythmic growth of nature in its varieties of plants.

The number of cultivated herbs is rather high. For convenience a distinction is made between herbs and spices. The first group combines plants which find a use in medicine as herb-teas or drugs. The spices, as you know, include all plants which are commonly used in the preparation of meals and foods. They become seasoning agents, like marjoram, basil, etc. But also the spices may — in small quantities — be used like herbs in the preparation of teas or drugs. Therefore, in the following, all these plants will be referred to as herbs.

From the preceding discussion the reasons can already be found why herbs have been grown by man since ancient times. Cosmeticians made use of the fragrant substances produced by these plants and knew how to compose the loveliest perfumes. It is rather simple to extract these substances, if it is necessary at all. Many plants impart their refreshing odor already by being rubbed on the skin or any other surface. It did not take long until cooking became an art merely through the use of herbs as seasoning agents. Often a cook was judged by his knowledge of adding the right herbs to the different dishes. So the herbs became also a culinary article. Their main field of application remained, however, medicine. Herbs served in preventing and curing ailments and diseases.

With the advancement of organic chemistry it was possible to synthetically produce compounds having the same odorous properties as the substances derived from herbs. Since their production is comparatively inexpensive, the cosmetic industry

replaced the natural extracts of herbs with fragrant compounds of artificial origin. In spite of this development some companies still prefer the odorous plant extracts in preparing cosmetic articles. Also in medicine many herbal preparations were replaced by synthetic drugs, though not to the same extent as in the field of cosmetics. Not all plant substances can be synthesized. Some herbs possess complicated combinations of compounds which make them valuable for medicine. Therefore commercial herb growing is still practiced extensively. Large quantities of dried herbs also find a market as herb-tea mixtures for different ailments or as regular herbal drinks. The use of herbs in the kitchen and in the processing of foods remained more or less unchanged. Many home-gardeners grow herbs for just this reason.

In order to realize the attractiveness of herb growing, several other reasons ought to be considered. Herbs should be grown in a garden

1. To overcome a monoculture in a garden,
2. To influence the atmosphere in a garden,
3. To get material useful for plant treatment,
4. To get material useful for animal and man.

The specialized growing of food crops in gardens and fields created the problems of monoculture. It favors the spreading of both insects and diseases. Methods of interplanting are proposed to overcome this problem. The presence of a few perennial herbs in a garden is in this respect of great value. Many — like hyssop or lemon balm — make good border plants and form within two years a kind of little hedge. They do not suppress the growth of the surrounding plants as vermouth would do. This plant requires for that reason a special corner in the garden. Peppermint and yarrow are easily grown in narrow beds and are tolerant enough not to mind being walked on. It also is not hard to restrict them to their place. Dill may even be sown together with carrots without doing harm.

Compared to our food crops herbs are plants which have remained rather healthy throughout the centuries of their existence. They hardly know insects that ever endangered their reproduction. This certainly can be contributed partly to the fact that herbs were not taken into the programs of breeding, a fate which befell all our vegetables. The herbs we grow today have the same characteristics and properties they had many, many years ago. And it is because of their inner health that

they serve today, as they have for centuries, in the fight against diseases and illnesses. Shouldn't the presence of such healthy plants help overcome the problems of monoculture?

Another factor shall briefly be mentioned, namely the correlation between vegetable and herb. The fragrant oils of herbs might very well improve the taste of vegetables. This field has not yet been studied, but it has been experienced that strawberries attain a much better flavor if mulched with pine needles. The flavor becomes similar to that of wild strawberries, sweet and aromatic.

Many herbs are known for their high content of volatile oils which give them their fragrance. These oils evaporate every minute, so that the herb creates its own atmosphere of scent. You can smell a field of peppermint several hundred feet away, showing how far these oils spread. Nobody has probably determined the height that these volatile oils might reach, though such knowledge would help extremely toward understanding the distribution of insects. Also our cultivated plants excrete such volatile oils, as the cabbage for instance the mustard oil. These oils, however, are of quite a different nature, but in one respect very important. They attract the destructive insects to our food plants. The food selection of these insects is very highly developed, meaning that a certain insect can live only on a certain plant species. Insects have also an extremely highly developed sense of smell and are able to perceive minute concentrations of odorous substances in the air, concentrations which we never will be able to measure. And since the insects are guided and attracted to their food by such vaporized volatile oils as plants excrete, we can try to influence the atmosphere of our garden by growing herbs. They evaporate oils which are *not* attractive to our destructive garden insects. Herb growing thus gives us a means of guiding the insects, of natural insect control.

Some of our garden insects even seem to prefer the fragrance of herbs to the odor of their food plants. It easily can be observed how the white cabbage butterfly neglects its cabbage if it finds hyssop in bloom. On a bright summer day dozens of these butterflies will dance above the hyssop, certainly attracted by the fragrant smell of this plant. As to the cabbage, this event might be called a distraction of insects. I personally did not observe any eggs of the cabbage butterfly deposited on the hyssop, but it is well possible. In such a case the young brood

could not develop because of their inherited specialized habit of food selection. Therefore a distraction of the adult female insect during the period of egg laying is all we have to aim at. In nature certainly more such cases occur which, however, do not catch the eye so readily as the white butterfly does.

The volatile oils of herbs are still present in the cut and dried plants and can be stored as such. It is well known that many herbs, mainly through their essential oils, have a fungicidal and bactericidal effect, meaning, that an extract of them can be employed in the control of diseases caused by fungi or bacteria. The diseases of our cultivated food plants are no exception. The herbs may be prepared for such an undertaking in several ways. The regular method of making a tea by pouring boiling water over the herbs is one way. The cold tea is then an ideal medium for the treatment of diseased plants. Putting herbs into cold water and allowing them to soak a day, also makes a kind of tea. The herbs may even be allowed to ferment in the water until a kind of liquid manure is forming. This liquid can be very useful, is, however, often not in much favor because the odor might be very disagreeable.

Among the cultivated herbs which can be prepared as a tea, camomile must be named first. A tea of camomile is very effective against a number of plant diseases, especially as long as the plants to be treated are young. Also damping-off in greenhouses and coldframes can be satisfactorily controlled by its use. Camomile should best be prepared in cold water. Sage is another herb useful in plant treatment. The tea should be made with boiling water. Its application can be recommended for older plants which have passed the stage of blooming, since an earlier application might retard growth in some tender plants. Hyssop is particularly useful for all those diseases which are caused by bacteria.

Garlic and onion must be mentioned here, though they accurately could not be called herbs. They can be very valuable, however, in the prevention of plant diseases. Extractions or teas of them are able to control such severe diseases as late blight on potatoes and tomatoes. Experiments also give hope of employing them effectively in the fight against brown rot of stone fruits. These liquids have to be used shortly after their preparation. Chives should not be forgotten because it has the same effect on diseases.

While discussing the subject of curing diseased plants, the

horsetail (equisetum arvense) appears as a prominent representative of the wild herbs. The horsetail is a very peculiar plant. It is a survivor of primitive times with its skeleton built up mainly of silic... The controlling effect of horsetail on fungus diseases is credited to this high amount of silica. A tea of the dried or fresh herb is made by boiling it for twenty minutes. The normal recipe is 1½ ounces of dried horsetail to one gallon of water. After straining, the tea can be sprayed on all plants which have their true leaves fully developed. The fragrance of the spray alone is a reward for the gardener.

While working with these delicate methods of disease control, a gardener should always remember the fact that these sprays are a direct means of control to a slight degree only. Their main success is in contributing to an effective prevention of diseases. It is always much easier to prevent than to cure. Therefore good practice calls for spraying the herb teas at regular intervals, taking the weather as a main guide!

In the experimentation of employing herb teas as insecticides, vermouth showed results in controlling aphids. Vermouth is a very bitter herb with toxic components which seem to have some effect on soft-bodied insects. The concentration of such a tea should not be too strong and not be repeated too often as a spray on tender vegetables, as it may retard their growth. Its proper field of application is to fruit-trees of all kinds.

Cultivated herbs still find their widest use in medicine and serve as source materials for many drugs. Many — like peppermint — are especially grown for their volatile oils. Since a gardener will not be too interested in the methods of processing herbs, another field of utilizing herbs will be discussed. This is the old practice of making home-grown herbal teas. For centuries many people knew the art of mixing herbs into teas for almost every illness. More and more this knowledge was forgotten. It is probably the reason why less herbs are grown by home-gardeners today than only a generation ago. But one really need not know how to make special herb mixtures in order to utilize herbs from the garden. A variety of herbs may be mixed into a regular herbal drink for the whole family. The more different herbs it contains the better, because one or a few herbs only, may act too one-sidedly. Also wild herbs should be included in such a "house-tea". Herbs offering their use are: Blackberry leaves, *raspberry leaves, peppermint, lemon balm, hyssop, camomile, fennel, anise, dill, calendula,* horsetail, *sage,*

plantain, *thyme*, stinging nettle, dandelion, *lavender*, St. John's wort (italicised are cultivated).

Animals also respond well if fed herb mixtures. Especially during the winter months herbs should be added to the feed, either in powdered form to the concentrate or as tea to the drinking water. Although wild herbs make up the bulk of such mixtures, the cultivated herbs offer their service for establishing hay and pasture fields. Members of the Umbelliferæ family such as fennel, caraway, and dill aid the excretion of milk in animals and may therefore be of value as a feed supplement in dairy herds.

The herbs may well be used for teas in their green stage, but it is commonly practiced to dry them before. The drying should be done in the shade. The herbs are generally chopped prior to drying, in order to speed up the drying process and to retain their green color. After drying, they have to be stored in a dry place.

Looking back now, over the whole development of herb growing, back to primitive man and his surroundings, the question might arise which plants did he find first, what we call today a food plant or what we call a herb plant? Could his plant food have been herbs? Very often herbs have a much higher vitamin content than our vegetables, and the different vitamins are also much better balanced. Still today many herbs — including the wild ones — might be prepared as food. Herbs, turned into a salad make a tasty dish. So as a final conclusion we learn that herb plants can be food plants, or — food plants can be herb plants.

BOOK REVIEW

COWS ARE GOURMETS?

GRASS PRODUCTIVITY, by Andre Voisin. Philosophical Library, Inc., 15 East 40th Street, New York 16, N. Y. 1959. $15.

The title of this book by the French farmer Andre Voisin, gives no hint of the really interesting information and ideas presented on the basis of many years of practice and study. He is concerned with presenting means of increasing the productivity of grasslands, but not simply through the introduction of new varieties, fertilizers, etc., but always in connection with the grazing animal. From his own studies and the few other studies

he has been able to find which attacked the problem from this angle he has come to the conclusion that "palatability is the link between the grass and the grazing animal". Cows prefer some plants to others. One can easily corroborate this statement by one's own observation. They do not simply stand still and eat straight ahead of themselves, but they range about, sniffing here and there, until they find just what they are looking for at the time. Indeed, when conditions are such that their preferred delicacy is not present, or very sparsely, they waste a great deal of energy looking for it, and do not get their full ration of grass. This last situation comes about because the cow seems to belong to a sort of union, at least she follows a rather definite rhythm of grazing about 7 or 8 hours out of the 24 and no more. So that when the grass is a good height for grazing, about 6 inches, then the cow does not need to range so far, and can thus eat the amount of grass she wants and needs within her particular time rhythm.

M. Voisin feels, that in addition to the sense of smell, which seems to be the sense most active when the cow chooses her food, she eats what she picks out in order to achieve a mixture which will enable her to ruminate with the greatest satisfaction. The process of ruminating certainly appears to be a peaceful and satisfying one and must have some influence on the diet, as well as the reverse influence being true. That is, that the diet has an influence on rumination.

Experiments carried out in Germany indicate that the cows prefer the indigenous plants in the permanent pasture to selected strains sown on the same type of land. Other studies in Nottingham, England, formed the basis for an index of palatability. Funnily enough, the plant at the top of the list is one considered to be a weed, the English plantain. The one at the foot of the list was a selected strain of cocksfoot — probably highly recommended by the plant breeders.

Fascinating as all these details are, however, they do not give a complete picture of what M. Voisin is driving at. He is presenting a method of grass, or pasture management which he chooses to call rational grazing. There are many methods advocated, under many different labels — rationed, rotational, Hohenheim System, etc., etc. These are all presented by Voisin in order to point out the differences between them and the method he calls *rational grazing*.

There are a number of factors involved in implementing

such a system into a farm economy. There is the growth curve of the grasses, the total pasture area, the number of animals to be carried, the number of divisions necessary so that periods of occupation will be long enough to properly graze the grasses and yet not too long so that they will be overgrazed, the varying lengths of the rest periods necessary at different times in the grazing season. Then there is the matter of access to water. It has been found, for instance, that if the animals are simply restrained by a single electric fence in front of them, which is moved ahead so much each day, and have free access to what they have already grazed because their drinking source is behind them, they will naturally regraze on the way back and the grass gets no rest. Besides, the animals are forever eating grass which is too young, and this can be harmful to them. There are many ways of dividing such pastures, providing one or two corridors with gates, using two movable electric fences, the outer fences being permanent ones. M. Voisin gives diagrams of many different possibilities in a separate chapter in his book.

Amongst the various factors listed in the preceding paragraph, the most important have to do with the growth curve of the grasses, the periods of occupation and the lengths of time necessary for the regrowth of the grass. In the region of France where Voisin's stock farm is located, in the northwest, the grasses make their strongest growth in May-June. The growth curve gradually slows down, so that in August it requires a rest period of 29 to 32 days as against some 14-18 days in May. The ideal height of the grass for the grazing cow is 6 inches. This is also the ideal height as far as the grass is concerned, since if it is grazed from this height what is left will be sufficient for the re-growth of the grass, for it to achieve a new "blaze of growth". If it is grazed or cut when it is shorter it will take longer for it to recuperate, there will not be sufficient green parts in proportion to the root left for the period of re-growth, indeed it can be permanently weakened as a consequence. Many pastures have degenerated as the result of continuous grazing, which is, of course, in effect, overgrazing.

Modern advice for the treatment of such run-out, weedy pastures, is to plough them up and re-seed them with new selected strains of grasses and legumes. It has been proven, however, that they can be re-established through rational grazing management. The weeds and unwanted grasses are cut down or driven out, the preferred grasses are strengthened, and some which were

not even present when the experiments began reappear and become established. Applications of fertilizer are used to assist in this process of pasture renewal. In fact, M. Voisin recommends the use of small quantities of complete fertilizers at critical periods during the grazing season to stimulate the re-growth of paddocks during the rest periods. Certainly Bio-Dynamic composts could be used to achieve the same results.

Up to a certain point, dependent upon the number of animals to be carried, a larger number of paddocks is preferable to a small number. The small number of larger area, results in a speeding up of rotation so that the area grazed first is returned to too soon, shortening the rest period. If the areas are too large for the number of stock this can also lead to undergrazing which is bad for the pasture in the long run. The re-growth will be uneven, many of the preferred grasses and legumes will be choked out.

The author stresses the need for flexibility when using rational management. It may be necessary to hold out some paddocks for later use when the growth rate of the grasses slows down, and it may happen that some of these would grow too tall before they are to be grazed. Then it would be necessary to mow them soon enough so that they will have re-grown when one desires to graze them. He recommends varying the order in which the paddocks are grazed from year to year, rather than always following the same rigid schedule of 1, 2, 3, etc.

M. Voisin has divided his stock into two groups, the cows in milk comprise the first group, the dry cows and young stock the second group. The milking cows are allowed to "cream the crop," the second group follows them on the second day to clean the pasture up, while the first group moves on to the next paddock and so on.

He has used rational grazing for 12 years (longer now) and in 1954 achieved a 6360 lb. production of starch equivalent per acre from his grazing land. This is much higher than the per acre starch equivalent production of his arable land, which is the same type of land and similarly situated. He certainly shows us that the productivity of grassland can be increased and the flora improved with this rational management of pastures. In this respect, he points out toward the end of his book that the use of the method may so increase the productivity that the farmer may well be overwhelmed with grass, have to increase his herd to cope with it, and find himself faced with a housing

and feeding problem in the fall. However, we wager it will be a rare and gifted farmer who will be faced with this dilemma. This possibility must be kept in mind, however, in determining the area one manages by the rational method.

The price of this book may seem rather high, yet the information which has been gathered together is invaluable. M. Voisin has gone back to the origins of rotational use of grasslands and quotes from French, English, and Scottish agriculturists and encyclopedic writers of the 15th and 16th centuries, as well as from experiments carried out in the 19th and our own 20th century. All that he recommends is based on his own hard won practical experience.

ALICE HECKEL

THE PRESERVATION OF MAN'S ENVIRONMENT

F. R. FOSBERG

Pacific Vegetation Project,
Care of National Research Council, Washington D.C., U.S.A.

Ecology being such an integral part of Bio-Dynamics (and Bio-Dynamics having so much to contribute to sound ecological programs), the editors feel that various studies in that science have a proper place here. So we want to express appreciation to that good friend of the B.D. Method, Richard Gregg, for passing along the following interesting paper, together with the author's permission to use it. It was delivered at the Ninth Pacific Science Congress, 1957, and is re-printed from the PROCEEDINGS of that organization, Volume 20, 1958.

One of the basic preoccupations of *human ecology* in the humid tropics, as elsewhere, is the effect man has on his environment. Contemplation of this relationship leads, inevitably, to the question: how long can man continue to exert such an effect and still have this environment capable of supplying his needs? When we ask this question, we enter the area of applied human ecology commonly known as *conservation.* This is a subject with immense practical interest, and in which emotion plays an essential part. It can be, and should be, treated in a scientific manner by the ecologist. He should, however, keep in mind that emotion is a vital and universal characteristic of the human part

of the system with which he is dealing. Emotional considerations must, therefore, be accorded their place in any attempt to consider man's relations with his environment and its resources.

Conservation is usually approached by serious students from the standpoint of economics, or, at best, from that of philosophy or aesthetics. These are both necessary and laudable approaches, as they stem from and appeal to two of the great sources of motivation in human society. The derivation of wealth from the resources of our environment and the appreciation of the beauty of this environment are two of our most obvious and easily grasped areas of contact with what we conceive as reality. Both are of fundamental concern to the human ecologist. The approach to conservation by human ecology, however, must be both broader and more penetrating than this to achieve the fullest understanding of the relation between man and his environment.

Perhaps the essential problem is that of man's ecological behavior. Most organisms occupy a very definite, usually rather restricted, position on a scale that ranges from the pioneer types who inhabit raw newly available habitats to the so-called "climax" organisms of mature stable communities. An important distinction separating these types is the duration of their occupancy of a habitat. The pioneer exerts a strong effect on its environment and tends to change it relatively rapidly, soon rendering it unsuitable for its own further occupancy. The climax organism, on the contrary, does not bring about or further such change, but lives in such adjustment with its environment that it is able to occupy it relatively permanently without serious modification. Indeed, such organisms may even tend to stabilize their environments and maintain equilibrium with them indefinitely.

The physiology of most organisms determines their patterns of ecological behavior and only changes in the organisms' genetic makeup can alter these patterns. Perhaps a possible exception to this is *Homo sapiens*. In man the emergence of the faculty of intelligence makes possible self-determination or choice of type of ecological behavior, probably for the first time in the course of organic evolution. Man, as a species, has it within his power to fulfill the role of a pioneer, but in all probability a temporary, member of the world biotic community, on the one hand, or the role of a permanent climax species, preserving or even renewing his habitat and living in equilibrium with it, on the other.

Modern man seems clearly to be following the role of a pioneer species. His numbers are increasing geometrically. His ability to modify his environment is likewise growing geometrically and is being used without restraint. His rate of consumption of the resources of his environment naturally follows the curve of the product of the two factors just mentioned.

Two points in this picture are of especial concern here. First, most of the resources essential to man's life or well-being are definitely limited in amount, and some are already in short supply. Second, man was physically and emotionally evolved to fit a particular range of habitats. By means of his technology he has managed to increase vastly this range. Physically little changed, he has spread into most of the natural environments on the earth's land surfaces and into a great diversity of those of his own making. Technologically it is probably feasible to modify almost any environment to accommodate human physical occupation. This will be true, as long as resources hold out, of all except, perhaps, habitats highly contaminated with radioactive materials. Man's physiology is reasonably well understood and his physical requirements are the preoccupation of most of the constructive effort of applied science. The limiting factor here is likely to be increasing scarcity or exhaustion of essential resources.

The adjustment between man's emotional and nervous makeup and these profound changes in his environment is a more immediately serious matter. The enormous rise in incidence of insanity and less acute nervous, mental, and emotional disorders in the most technologically advanced countries is an indication that all is not well. Neither the physiology of the nervous system nor the functioning of the human mind and emotions are understood nearly as well as are the physical requirements of man. His nervous system, and its product, the mind, have shown themselves to be very resilient and have adapted to an amazing amount of change from the situations they were evolved to meet. But the percentage of failure grows higher with the degree of change of the environment from what the human organism was evolved to fit.

It is entirely possible, even probable, that this is the modern form assumed by natural selection in the continued evolution of man. If so, this means that the surviving portion of the human race will be different from man as we know him now. What he will become as a result of this process is not easy to predict.

Certain it is that to meet the strain of the new environment and the disappearance of the quiet and beauty of the old, man's nature will be changed. He will be harder, and the gentler traits that we now admire, as well as the appreciation of and need for the beauty of nature, will be bred out of him.

It is entirely possible that man will not survive the changed environment that he is creating, either because of failure of resources, war over their dwindling supply, or failure of his nervous system to evolve as rapidly as the change in environment will require. Or he may only survive in small numbers, suffering the drastic reduction that is periodically the lot of pioneer species, or he may change beyond our recognition. All these alternatives have plenty of precedents among pioneer plant and animal species in nature.

If these fates are not palatable to man, the possibility of assuming another role than that of the pioneer may still be open to him. If this is true, it will be the part of the sciences of geography and ecology, especially the latter, to show him the way. These, as well as the other sciences now give him the power to change his habitat. These two, alone, have as a principal function the building up of knowledge and understanding of the environment as such. Ecology studies the nature of and differences between pioneer and climax species. The changes in man's treatment of his environment necessary to establish a permanent equilibrium with it can only be formulated through a broad ecological approach. The understanding of biotic communities is the ecologist's major potential contribution. How to achieve a stable biotic community with man as a member is certainly the most important single question ever to face any branch of applied science.

How this question may be answered will not be discussed at length, as no answer is yet available. It must certainly involve some means of stabilizing or even reducing the human population of the world. It will involve the elimination or control of greed and the rational, balanced use of natural resources. Management and utilization of the environment on a true sustained yield basis must be achieved. And all this must be accomplished without altering the environment beyond the capacity of the human organism as we know it to live in it.

This will require, on a scale not imagined heretofore, the functioning of ecology in its traditional role of utilizing and integrating the data provided by other sciences. To accomplish

the task here outlined will require use of information from the usual physical and biological sciences, as well as the data and principles of ecology itself. Perhaps even more important eventually may be the findings of the social sciences. As the task progresses and basic understanding develops, the human factor will loom larger and larger. As the physical and biological framework is outlined, the task of fitting man into it and establishing his role in the new system will become paramount. Even more critical will be the educational task of influencing man to assume this role.

The undertaking, admittedly, appears impossible. It does seem to be the only road toward preservation of an environment satisfactory for the continued existence of the sort of man that we know. Whether as a scientific community we are sufficiently interested, farsighted, or courageous to attack such a problem may well determine the future of man on the earth.

AN ECOLOGICAL FABLE

At a field's edge
A lad, in dappled sunlight under an oak, lay basking
And idly of himself was asking
The answer to this riddle of the world around
Him: Why these acorns scattered on the ground
Grew on the mighty oak
While yonder in the field great pumpkins grew
On earthbound vine. A joke
Of Nature? Surely a miscalculation.
Large trees should yield large fruit
And tiny fruit should be the yield of creeping shoot
So he concluded, in smug speculation.
But as an acorn dropped and struck him on the head
He, though no Newton who from an apple's fall
Deduced the law that holds us all
To Earth, yet saw how Nature in her ways is wise.
For had that acorn been of pumpkin flesh and size
He would have been bedrenched — pate, ears, nose, eyes —
And reeling, as from a light blow
With a sledge.

And now we have the Moral, friend,
For the Moral is a Fable's proper end:
He who would shake an oak for pumpkin pie
Let him first know
Where pumpkins grow
And why.

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